

Appl. No. 10/810,533
Amdt. dated 02/15/2006
Reply to Office Action of 11/16/2005

Attorney Docket No.: N1085-00261 [TSMC2003-1117]

Amendments to the Claims:

This listing of claims will replace all prior versions and listings of claims in the application:

- 1 1. (Currently Amended) A method for mapping surface topography of a substrate comprising:
 - 3 forming a non-metallic film over a metal-free substrate;
 - 4 forming a single metal film over said non-metallic film, said metal film not being a refractory metal;
 - 6 polishing to remove at least a portion of said metal film; and
 - 7 distinguishing first regions in which said metal film remains, from second regions in which said metal film has been removed and said non-metallic film is exposed, by directing a beam of an optical signal to scan across a top surface of said substrate at a plurality of locations and in a plurality of arcuately spaced directions.
- 1 2. (Original) The method as in claim 1, wherein said forming a non-metallic film over a substrate comprises forming a dielectric film over a semiconductor substrate.
- 1 3. (Original) The method as in claim 1, wherein said substrate includes at least one further film formed thereover, and said forming a non-metallic film comprises forming a dielectric film over said at least one further film.
- 1 4. (Original) The method as in claim 3, wherein said at least one further film includes a patterned polysilicon film and a polished interlevel dielectric film formed thereover.
- 1 5. (Currently Amended) The method as in claim 3, ~~wherein said polishing and said distinguishing take place during in-line processing of semiconductor devices being formed on said substrate and further comprising generating two-dimensional topographical data of a surface of said substrate~~.

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1 6. (Original) The method as in claim 1, wherein said forming a metal film comprises
2 forming a copper film.

1 7. (Original) The method as in claim 1, wherein said polishing comprises chemical
2 mechanical polishing (CMP).

1 8. (Currently Amended) The method as in claim 1, wherein said distinguishing
2 includes using an interferometer to monitor said optical signal signals-directed-to-a-top
3 surface-of-said-substrate.

1 9. (Original) The method as in claim 1, wherein said distinguishing is repeated
2 periodically during said polishing.

1 10. (Currently Amended) The method as in claim 1, wherein said distinguishing
2 comprises directing said beam to scan in a plurality of non-radial directions is-repeated
3 substantially-continuously-during-said-polishing.

1 11. (Currently Amended) The method as in claim [[10]] 1, wherein said distinguishing
2 includes spatially distinguishing said first regions from said second regions a plurality of
3 times during said polishing, and further comprising generating a three-dimensional
4 topographical map of said substrate based on said distinguishing.

1 12. (Currently Amended) The method as in claim 1, wherein said distinguishing
2 includes directing an-optical-signal-to-a a-plurality-of-said-beams-to-said top surface of
3 said substrate and using an interferometer to detect one of a return refracted signal and
4 a return reflected signal.

1 13. (Cancelled)

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1 14. (Original) The method as in claim 1, further comprising generating a map of
2 substrate topography based on data obtained during said distinguishing.

1 15. (Original) The method as claim 14, further comprising instituting in-line process
2 controls based on said map.

1 16. (Original) The method as in claim 14, wherein said first regions correspond to
2 relatively depressed regions of said substrate and said second regions correspond to
3 relatively raised regions of said substrate.

1 17. (Currently Amended) The method as in claim [[1]] 12, wherein said substrate is
2 generally round and includes a diameter of about 12 inches and said distinguishing
3 includes monitoring said optical signal at signals-directed-to a plurality of locations, each
4 of said plurality of locations separated from other of said plurality of locations by about
5 10-20 mm.

1 18. (Currently Amended) The method as in claim 1, wherein said substrate
2 comprises a semiconductor substrate upon which a plurality of semiconductor devices
3 are being formed, and said distinguishing includes directing said beam to scan along
4 monitoring-optical-signals-directed-to a plurality of scribe lines between respective
5 semiconductor devices of said plurality of semiconductor devices on said semiconductor
6 substrate.

1 19. (Currently Amended) A method for mapping surface topography of a substrate
2 comprising:
3 forming a non-reflective film over a metal-free substrate;
4 forming a single reflective film over said non-reflective film, said reflective film not
5 being a refractory metal;
6 polishing to remove at least a portion of said reflective film; and

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7 distinguishing first regions in which said reflective film remains, from second
8 regions in which said reflective film has been removed and said non-reflective film is
9 exposed by scanning a plurality of beams of an optical signal across a top surface of
10 said substrate at a plurality of locations and in a plurality of arcuately spaced directions.

1 20. (Currently Amended) An apparatus for in-line monitoring of surface topography of
2 a substrate comprising:

3 a body for receiving a substrate thereon;
4 polishing means for polishing a surface of said substrate;
5 means for scanning a plurality of beams of an optical signal across a top surface
6 of said substrate at a plurality of locations and in a plurality of different directions; and
7 detecting means for detecting a presence or absence of [[a]] any reflective
8 material film at a plurality of arcuately spaced, non-linear locations [[on]] of said
9 substrate surface during said polishing operation.

1 21. (Cancelled).

1 22. (Original) The apparatus as in claim 20, wherein said detecting means comprise
2 an interferometer.

1 23. (Original) The apparatus as in claim 20, wherein said polishing means comprise
2 a chemical mechanical polishing apparatus.

1 24. (Currently Amended) The apparatus as in claim 20, wherein said detecting
2 means detects a presence or absence of said reflective film at a plurality of locations on
3 said surface, several times during a polishing operation.

1 25. (Original) The apparatus as in claim 20, further comprising display means that
2 provide an output indicative of topography of said substrate.

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- 1 26. (Original) The apparatus as in claim 25, in which said display means is coupled
- 2 to electronic circuitry that compares said output to pass/fail criteria.